

In situ study of the temperature-dependent crystallization process of Vanadium Carbide

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Hard coatings are of significant scientific interest due to their vast applications in industry. Magnetron sputtering techniques combined with In situ X-ray analysis during thin film deposition are extremely useful tools to understand the interplay between the microstructure and macroscopic coating properties. For this purpose a mobile UHV compatible sputtering chamber with many distinguish features was developed and is stationed in the UHV analysis laboratory of the Angströmquelle Karlsruhe (ANKA).

Here we study the influence of the growth temperature and deposition time on the structural properties of the hard coating material Vanadium Carbide (VC). In situ powder diffraction and reflectivity measurements were performed during the deposition of VC at different substrate temperatures. The powder rings obtained during the in-situ measurements exhibits change in the orientation and structural properties as a function of temperature. The reflectivity measurements provide information about thickness, roughness and electron density of the films. Additionally, as a complementary method ex situ Atomic Force Microscopy (AFM) is used to understand the surface morphological changes in real space. The aim of this project is to develop a model for the structure formation of polycrystalline sputtered thin films as a function of plasma parameters, temperature and deposition time.